ADAPTIVE MESH REFINEMENT IN ACCELERATOR MODELING WITH *OMEGA3P*

Y. Luo[a,c], **I. Malik**[b,d], **Z. Li**[b,e], **Mark S. Shephard**[a,f], **K. Ko**[b,g]

[a]Scientific Computation Research Center (SCOREC)
Rensselaer Polytechnic Institute
Troy, NY 12180
[c]yluo@scorec.rpi.edu, [f]shephard@scorec.rpi.edu

[b]Stanford Linear Accelerator Center (SLAC)
Stanford University
Menlo Park, CA 94025
[d]imalik@stanford.edu, [e]lizh@SLAC.Stanford.EDU, [g]kwok@SLAC.Stanford.EDU

Numerical modeling has become a standard tool for the R&D of accelerator cavities, especially those being considered for next generation facilities as they are faced with increasingly stringent specifications on tolerances and continue to grow in complexity with new functionalities[1]. Such requirements pose computational challenges not easily met by existing codes running on desktops. Under DOE's SciDAC program, the finite element eigensolver Omega3P has been developed for designing next-generation accelerator cavities on supercomputers[2]. It has demonstrated to be capable of calculating cavity mode frequencies to within 0.01 percent accuracy in 3D complex geometries. Present effort focuses on developing the capability for finding the wall loss with a high degree of accuracy which is important for evaluating cavity performance and its heating management. The difficulty arises when there is significant loss confined to a small surface area of complicated shape requiring very fine meshes to model correctly. Mesh refinement by hand neither guarantees convergence nor makes optimal use of computing resources. A SciDAC collaboration is in place to develop an automatic mesh adaptation procedure for improving the accuracy of wall loss calculations through a geometry-based mesh modification algorithm[3]. Numerical results from simulating the Trispal cavity design with this approach using various error metrics in the refinement loop will be presented and compared.

References

[1] K. Ko, N. Folwell, et. al., "Electromagnetic Systems Simulation — *From Simulation to Fabrication*", *2003 DOE SciDAC PI Meeting*, Napa, California, March 10-11, 2003.
[2] Y. Sun et. al., "High precision accelerator cavity design using the parallel eigensolver *Omega3P*", *Proc. of 18th Annual Review of Progress in Applied Computational Electromagnetics ACES 2002*, Monterey, CA.
[3] J.-F. Remacle, X. Li, M. S. Shephard and N. Chevaugeon, "Transient mesh adaptation using conforming and non-conforming mesh modifications", *11th International Meshing Roundtable*, Sandia National Laboratories, pp. 261-272, 2002.